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DEVICE FOR PROCESSING THE EDGE OF AN OBJECT
[Einrichtung zum Bearbeiten des Randes eines Gegenstandes]

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The invention relates to a device for processing the edge of an object, for example flat glass products, hollow glass products, stone or ceramic objects, etc., with a tool, in particular a grinding or polishing disk rotating about an axis, and with a cooling device for a coolant, such as cooling water or a cooled gas, e.g., cooled air, allocated to the tool. The tool can be, for example, a milling tool.

During processing, i.e., in particular when grinding or when polishing, for example the edge of flat glass products such as shelf bottoms, glass doors, motor vehicle windshields etc., heat is produced that must be eliminated in order to ensure an optimum edge processing of the flat glass products. The same also applies to any other objects, such as hollow glass products, stone or ceramic objects /2*
etc. For heat removal, i.e., for the cooling itself, a cooling liquid, cooling water in particular, is used. A cooling gas can also be used instead of a cooling liquid.

A known device of the kind specified above has a cooling device with a plurality of articulated hoses which are arranged concentrically to the processing tool, i.e., to the grinding or polishing tool. These articulated hoses have to be adjusted individually. This represents a non-negligible expense of time and labor, so that often during a tool change, i.e., when replacing a grinding or polishing disk of a certain diameter by a grinding or polishing disk of a different diameter, the articulated hoses are not adjusted according to the new tool. In order to ensure sufficient cooling in the case of such non-optimum setting of the articulated hoses, in known devices the volume of coolant liquid, i.e., the consumption of cooling water, is very large. This may cause a problem under certain environmental circumstances. Thus, said articulated hoses often do not allow proper orientation, i.e., precise guidance of the cooling liquid, i.e., the cooling water, to the processing site, i.e., to the grinding or polishing site at the edge of the flat glass product being processed.

* [Numbers in right margin indicate pagination of the original text.]

The invention is based on the problem of creating a device of the kind specified above in which the cooling medium such as a cooling liquid, cooling water in particular, is directed specifically to the particular processing site at the edge of the flat glass product, thus implementing optimum heat removal and edge processing, i.e., grinding or polishing, a relatively small consumption of cooling medium.

In the case of a device of the kind specified above, this problem is solved according to the invention /3
in that the cooling device has a cooling rim surrounding the tool and, having on its interior side facing the tool, nozzle holes distributed along the perimeter, said nozzle holes each enclose a first acute angle with the axis of rotation of the tool. For example, the cooling rim has a diameter of 250 mm, and for example, 90 nozzle holes are distributed along the perimeter of the cooling rim. Of course, the cooling rim can also have a different diameter and a different number of nozzle holes. The nozzle holes can be arranged uniformly or irregularly. By means of the cooling rim designed according to the invention, cooling medium, for example, cooling liquid, cooling water in particular, can be directed specifically onto the processing edge of the particular grinding or polishing disk—or onto a milling tool—and thus specifically onto the edge of the object being processed, such as a flat glass product, for example, so that optimum cooling is achieved with relatively small consumption of cooling medium. Optimum grinding or polishing will result due to this optimum cooling. The same also applies to milling work on an object.

To achieve the same purpose, i.e., optimum processing with little consumption of cooling medium, it is useful in a device according to the invention if the nozzle holes each also enclose a second acute angle along the perimeter of the tool. This second acute angle preferably is simultaneously oriented to the direction of rotation of the tool, so that the cooling medium in the form of a cooling liquid, for example, is carried along with the rotating tool. In this manner, the use of cooling medium is additionally optimized and the cooling effect is additionally improved, which means that the tool performance can be /4
further improved.

In order to be able to process edge contours having differing radii of curvature with the device according to the invention in a time-saving and optimum manner, the tool has at least two tool elements of different diameters that are adjustable in the direction of the tool axis, and the nozzle holes in the cooling rim are arranged in rows of nozzle holes allocated to the tool elements and offset axially from each other. The tool with the at least two tool elements of different diameters is moved preferably by means of a CNC controller along the edge of the object being processed, such as the edge of a flat glass product. By means of the CNC controller, simultaneously also the nozzle holes belonging to the tool element in the processing clamp will be controlled in order to release the cooling medium. Another possibility consists in the nozzle holes allocated to the at least two tool elements of different diameters being spaced equally from and alternating with each other at the same rim level.

The specific tool element pertains in particular to a grinding or polishing disk of a certain diameter.

The nozzle holes in the cooling rim allocated to the tool elements of different diameters have preferably different first and second acute angles, in order to cool the particular tool element in operation at its perimeter and/or at the processing site at the edge of the object being processed, such as a flat glass product, for example.

According to the invention, the nozzle holes allocated to the at least two tool elements of different /5
diameters can be connected to a common ring channel formed in the cooling rim. In this kind of design, the cooling medium flows for example, in the form of a cooling liquid, cooling water in particular, through all nozzle holes at all times. In order to further reduce the consumption of cooling medium, it is preferable that the nozzle holes allocated to the particular tool element be connected to an associated ring channel formed in the cooling channel. With a design of this kind, it is useful to provide an adjusting drive for adjusting the tool elements in the direction of the tool axis, and that the ring channels formed in the cooling rim be each connected to one cooling-medium inlet and blocking device that is

connected to the adjusting drive over the CNC controller. This kind of device according to the invention has the advantage that a particular relevant tool element can be moved in a simple and time-saving manner to the edge of the object to be processed, such as a flat glass product, and simultaneously also the particular ring channel can be supplied with cooling medium. Thus, the adjusting effort is reduced to a minimum, and at the same time, optimum cooling is ensured for the particular tool element in use.

According to the invention the at least one ring channel formed in the cooling rim can be an uninterrupted design, and one coolant-medium inlet and blocking device is allocated to the/each ring channel. In a design of this type for the device according to the invention, the liquid or gaseous cooling medium is emitted from the particular ring channel through the entire perimeter of the cooling rim. In order not to emit the cooling medium along the entire perimeter of the tool element, i.e., of the grinding /6
or polishing disk of a certain diameter, but rather to supply said coolant only at the processing site for the tool element, it is preferred that the at least one ring channel formed in the cooling rim be divided into mutually separate channel segments, wherein a controllable coolant inlet and blocking device is allocated to each channel segment.

The device according to the invention has the advantages that the quantity of gaseous or liquid cooling medium, cooling water in particular, employed to achieve optimum cooling of the tool and/or of the particular tool element of a particular diameter, be minimal and that, moreover, the particular tool, i.e., the particular tool element of a certain diameter can be applied in a simple and time-saving manner, to the edge of the object to be processed, such as a flat glass product for example, and at the same time can also direct the cooling medium appropriately to the tool or tool element presently in use.

Additional details, features and advantages are indicated in the following description of design embodiments of the invented device or of important details thereof as shown in the figures.

We have:

Figure 1, a schematic view from above of a section of an object in the form of a flat glass product whose edge is to be processed, i.e., whose edge is to be ground or polished, and also an appurtenant /7
tool in the form of a grinding or polishing disk,

Figure 2, a grinding or polishing disk combined with a nozzle hole, illustrated schematically as seen from above,

Figure 3, the grinding disk and nozzle hole from Figure 2 in a side view, i.e., as seen in the direction of arrow III in Figure 2,

Figure 4, a schematic illustration of a cooling rim with an uninterrupted perimeter ring channel, wherein several of the nozzle holes are shown,

Figure 5, an illustration similar to Figure 4 of a different design of the cooling rim with a ring channel which is divided into mutually separated channel segments, wherein several of the nozzle holes are shown similar to Figure 4,

Figure 6, a schematic illustration similar to Figure 1 to illustrate a device with a segmented cooling channel as per Figure 5 to show the active channel segments, i.e., those actually in use,

Figure 7, an illustration similar to Figure 6 to show the active channel segments of the cooling rim located at another edge section of the flat glass product as per Figure 5,

Figure 8, a cross section through an embodiment of the device with a tool, i.e., with a grinding or /8
polishing disk of a particular diameter,

Figure 9, a top view of the device according to Figure 8, shown in the direction of arrow IX in Figure 8,

Figure 10, a section of another embodiment of the invention, in a perspective, exploded view,

Figure 11, a spatial illustration of a cooling rim with an uninterrupted, perimeter ring channel and nozzle holes (arranged in two rows) with different first and second acute angles,

Figure 12, a spatial illustration of a section of another embodiment of the cooling rim with two uninterrupted perimeter ring channels, to which nozzle holes of a particular first and second acute angle are allocated, and

Figure 13, a perspective section of an embodiment of the device with a cooling rim according to Figure 12, wherein the ring channels are segmented.

Figure 1 shows a section of a flat glass product 10 in which we are dealing, for example, with a shelf bottom, a glass door, a motor vehicle windshield or such. The flat glass product 10 has an edge 12 that /9
is being ground or polished by means of a CNC-controlled tool 14. The tool 14 relates to a grinding or polishing disk 16 of a particular diameter. The grinding or polishing disk 16 is driven in a rotational manner about its tool axis 18. The direction of rotation of the grinding or polishing disk 16 is indicated by the curved arrow 20. The propulsion of the grinding or polishing disk 16 parallel to the edge 12 of the flat glass product 10 under process is indicated by the arrow 22 and takes place in the direction opposite the direction of rotation 20 of the grinding or polishing disk 16 in order to achieve optimum grinding or polishing.

Figure 2 illustrates the tool 14 schematically in the form of a grinding or polishing disk 16 and also a cooling rim 24 arranged concentric to the tool 14. This cooling rim has nozzle holes distributed uniformly along the perimeter. Only one of the nozzle holes is illustrated schematically in Figure 2 and is denoted by reference number 26. As is also evident in Figure 3, the particular nozzle hole 26 is directed toward the perimeter edge 28 of the grinding or polishing disk 16 in order to ensure optimum cooling of the grinding or polishing disk 16 with minimum coolant consumption.

The particular nozzle hole 26 encloses a first acute angle 30 (see Figure 3) with the rotation axis 18, i.e., with the tool axis of the tool 14, i.e., with the grinding or polishing disk 16. Figure 2 illustrates that the particular nozzle hole 26 encloses a second acute angle 34 along the perimeter of the grinding or

polishing disk 16, i.e., with the particular tangent 32. In addition, from Figure 2 it is evident that the second acute angle 34 is oriented synchronously with the direction of rotation 20 of the tool 14, i.e., of the grinding or polishing disk 16.

Figure 4 uses a schematic illustration similar to that of Figure 2 to illustrate a cooling rim 24 with a /10
ring channel 36, which is designed as uninterrupted along the perimeter in the cooling rim 24. Reference number 26 denotes several of the nozzle holes arranged in the cooling rim 24; these holes are arranged equidistant from each other along the perimeter of the cooling rim 24. Conversely, Figure 5 illustrates an embodiment of the cooling rim 24 wherein the ring channel 36 is divided into mutually separated channel segments 38.

The same details in Figures 4 and 5 are denoted with the same reference numbers as in Figures 1 to 3, so that it is redundant to describe all these details again in conjunction with Figures 4 and 5.

Using an illustration similar to Figure 1, Figure 6 shows a section of a flat glass product 10 whose edge 12 is to be processed, wherein a device with a cooling rim 24 is applied, as is illustrated schematically in Figure 5, which has a number of channel segments 38 distributed uniformly along the perimeter. The two channel segments 38' facing the edge 12 of the flat glass product 10 are shown by thicker lines. Both of these channel segments 38' pertain to those channel segments which are affected by the cooling liquid, cooling water in particular, whereas the remaining channel segments 38 are not affected by cooling liquid, i.e., cooling water, so that the consumption of coolant is reduced accordingly. Furthermore, Figure 6 shows the advancing direction 22 of the tool. Figure 7, using the angled arrow 40, illustrates the transition of the grinding or polishing disk from one section of the edge 12 to another, enclosing an angle with the first section. During this transition from one edge section to another edge /11
section, a switch occurs to the new channel segment 38" facing the edge section. The other channel segments 38, again, are not affected by the cooling liquid, i.e., cooling water.

Figure 8 uses a cross-sectional illustration to show an embodiment of the device 40 for processing of the edge 12 of a flat glass product 10. The device 40 has a clamping device 42 for a tool 14. The tool 14 is formed by a grinding or polishing disk 16.

The device 40 has a housing 44 which is designed as a housing dome. A cooling rim 24 is tightly connected to the housing 44 and this cooling rim is designed with a ring channel 36 (see also Figure 4, for instance). Along the perimeter of the cooling rim 24 there are nozzle holes 26 formed on the interior side 46 thereof facing the tool 14. These holes extend to the ring channel 36. A cooling liquid inlet 48 is connected to the ring channel 36.

In order to prevent the cooling liquid from spraying out to the side, a brushing curtain 50 is provided around the housing 44 of the device 40.

Figure 9 shows a top view of the device 40 as per Figure 8.

Figure 10 shows an exploded cutaway view of one embodiment of the device 40 with a cooling rim 24, a housing 44 and a tool 14, wherein the cooling rim 24 is formed by mutually separated channel segments 38. A cooling-liquid inlet and blocking device 52 is allocated to each channel segment 38 in the housing 44. The housing 44 has a perimeter supply channel 54 to which a cooling liquid inlet 48 is connected. Nozzle holes denoted by reference number 26 in Figure 10 extend from the particular /12
channel segment 38 to the interior side 36 of the cooling rim 24.

Figure 11 shows one embodiment of the cooling rim 24 with an uninterrupted perimeter ring channel 36. The cooling rim 24 is designed with nozzle holes 26' and with nozzle holes 26", which are arranged in two rows axially offset from each other. The nozzle holes 26' are allocated to one tool element, i.e., to one grinding or polishing disk 16' of a particular diameter, and the nozzle holes 26" are allocated to one tool element, i.e., to a grinding or polishing disk 16" of a different diameter (see Figure 13). The nozzle holes 26' and 26" have different first and second acute angles 30 and 34 (see Figures 2 and 3).

Figure 12 illustrates a perspective view of a section of one cooling rim 24 which likewise has nozzle holes 26' and 26", which are arranged in rows spaced axially from each other. The nozzle holes 26' in the embodiment of the cooling rim 24 illustrated in Figure 12 are allocated to one ring channel 36' and the nozzle holes 26" to a ring channel 36". The ring channels 36' and 36" are separated from each other; they can be designed as uninterrupted on the perimeter or—similar to the illustration in Figures 5 and 10—can be designed with mutually separated channel segments 32.

Figure 13 illustrates one embodiment of the device 40 for processing, i.e., for grinding or polishing of the edge 12 of a flat glass product 10. Two tool elements, i.e., grinding or polishing disks 16' and 16" with different diameters are attached to the clamping device 42 of the device 40.

The device 40 has a housing 44—similar to the housing 44 illustrated in Figure 10. A cooling rim 24 /13
is tightly and securely attached to the housing 44. This cooling rim is designed similar to the cooling rim 24 illustrated in sections in Figure 12, but the two ring channels 36' and 36" thereof are designed as channel segments 38, so that only the channel segments 38' or 38" (see Figures 6 and 7) neighboring the edge 12 of the flat glass product 10 are affected by the cooling liquid, i.e., cooling water. This is indicated in Figure 13 by the small-diameter water jets 56 on the right side of the grinding or polishing disk 16. The nozzle holes 26' not belonging to the grinding or polishing disk 16" in use, are not activated. Similarly also for the nozzle holes 26" shown in Figure 13 on the left side of the clamping device 42, which belong to inactive channel segments 38 (see also Figures 6 and 7).

List of reference symbols /14

10 Flat glass product

12 Edge (of 10)

14 Tool (for 12)

16	Grinding or polishing disk (of 14)
18	Tool axis (of 14 and/or 16)
20	Direction of rotation (of 16)
22	Arrow (of 16)
24	Cooling rim (of 40)
26	Nozzle holes (in 24)
28	Perimeter edge (of 16)
30	First acute angle (between 26 and 18)
32	Perimeter direction/tangent (of 28)
34	Second acute angle (between 26 and 32)
36	Ring channel (in 24)
38	Channel segments (of 36)
40	Device (for 14)
42	Clamping device (of 40 for 14)
44	Housing (of 40)
46	Interior side (of 24)
48	Coolant inlet (of 40)
50	Brushing process (at 44)
52	Coolant inlet and blocking device (for 38)
54	Supply channel (in 44 for 36)
56	Water jets (through 26)

Claims /15

1. Device for processing of the edge (12) of an object, such as for example, of flat glass products (10), with a tool (14) such as a grinding or polishing disk (16) or a milling tool rotating about an axis (18), and with a cooling device for a coolant liquid, in particular for coolant water, allocated to the tool (14), characterized in that the cooling device has a cooling rim (24) surrounding the tool (14) and having on its interior side (46) facing the tool (14), nozzle holes (26) distributed along the perimeter, said nozzle holes each enclosing a first acute angle (30) with the axis of rotation (18) of the tool (14).

2. Device according to Claim 1, characterized in that the nozzle holes (26) each also enclose a second /16
acute angle (34) along the perimeter (32) of the tool (14).

3. Device according to Claim 2, characterized in that the second acute angle (34) is simultaneously oriented to the direction of rotation (20) of the tool (14).

4. Device according to one of Claims 1-3, characterized in that the tool (14) has at least two tool elements (16) of different diameters that are adjustable in the direction of the tool axis (18).

5. Device according to Claim 4, characterized in that the nozzle holes (26) in the cooling rim (24) are arranged in rows of nozzle holes (26', 26") allocated to the tool elements (16) and axially offset from each other.

6. Device according to Claim 4, characterized in that the nozzle holes (26', 26") allocated to the at least two tool elements (16) of different diameters are spaced equally from and alternating with each other within the same rim plane.

7. Device according to one of Claims 4-6, characterized in that the nozzle holes (26', 26") allocated to /17
the tool elements (16) of different diameters have different first and second acute angles (30 and 34).

8. Device according to one of Claims 4-7, characterized in that the nozzle holes (26', 26") each allocated to the at least two tool elements (16) of different diameters are connected to a ring channel (36) formed jointly in the cooling rim (24).

9. Device according to one of Claims 4-7, characterized in that the nozzle holes (26', 26") allocated to the particular tool element (16) are connected to an associated ring channel (36', 36") formed in the cooling rim (24).

10. Device according to Claim 9, characterized in that an adjusting drive is provided for adjusting of the tool elements (16) in the direction of the tool axis (18), and in that the ring channels (36', 36") formed in the cooling rim (24) are each connected to a coolant inlet and blocking device (52) that are connected together with the adjusting drive by means of a control device.

11. Device according to one of Claims 8-10, characterized in that the at least one ring channel (36) /18
formed in the cooling rim (24) is of uninterrupted design, wherein a coolant inlet and blocking device (52) is allocated to the/each ring channel (36, 36', 36").

12. Device according to one of Claims 8-10, characterized in that the at least one ring channel (36, 36', 36") formed in the cooling rim (24) is divided into mutually separate channel segments (38), wherein a coolant inlet and blocking device (52) is allocated to each channel segment (38).

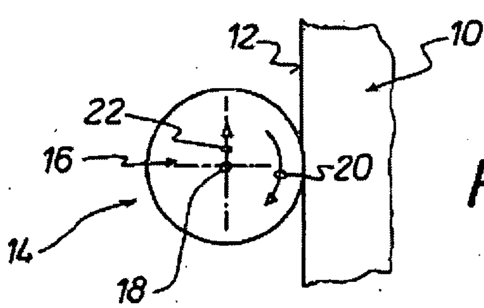


FIG.1

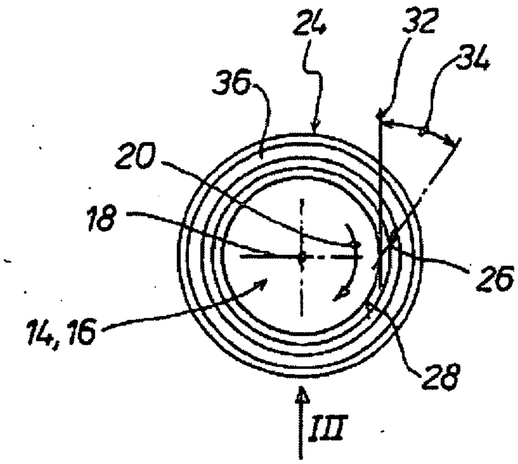


FIG.2

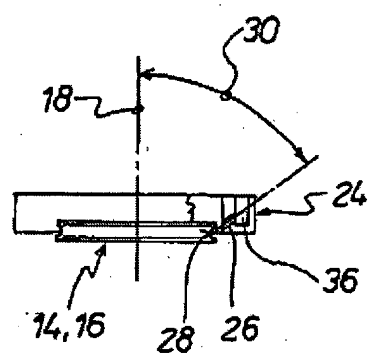


FIG.3

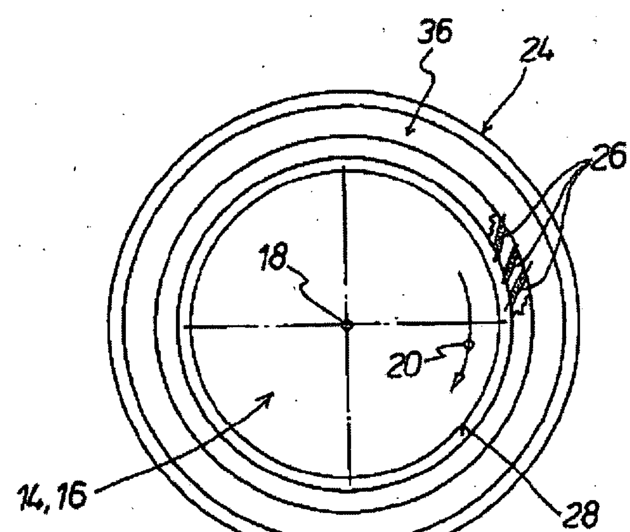


FIG.4

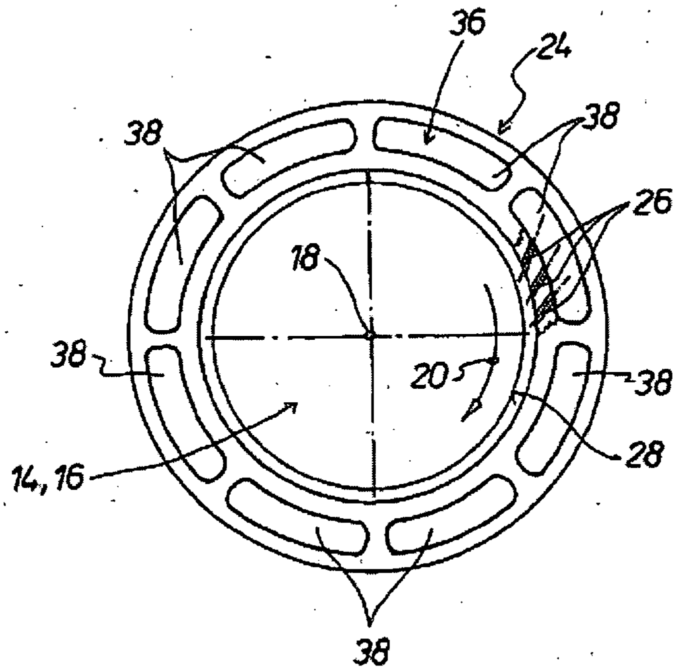


FIG.5

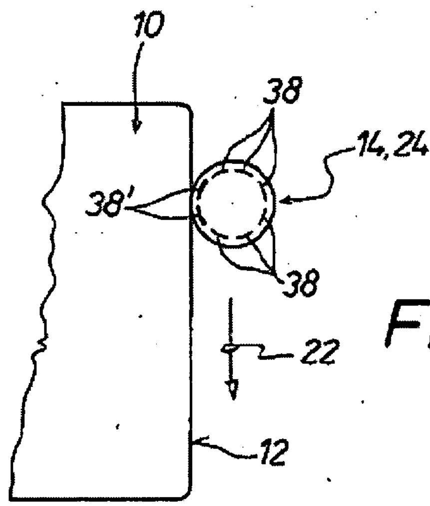


FIG.6

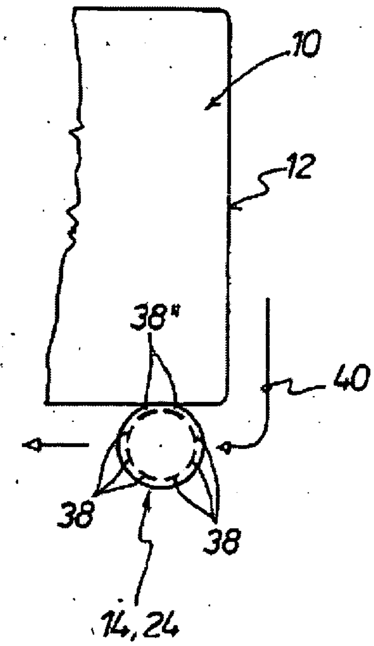
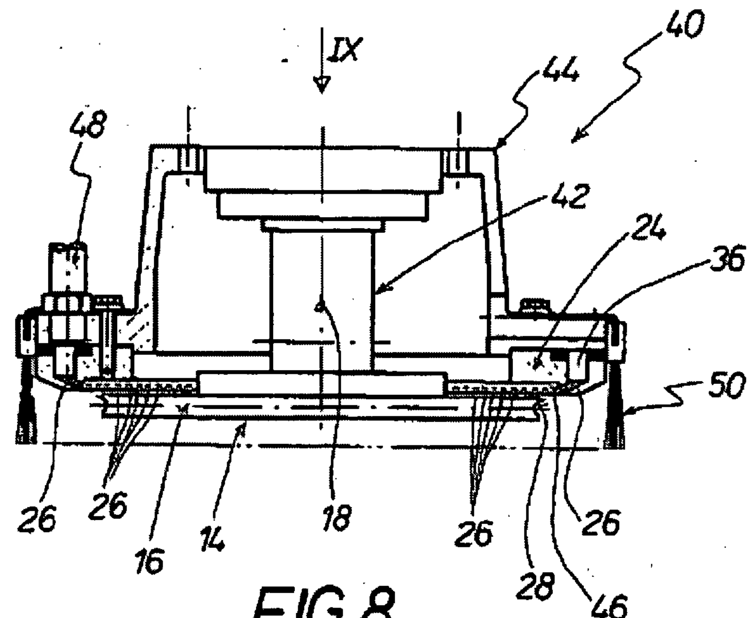

10
12
38"
40
38
38
14,24

FIG.7


IX
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44
48
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36
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26
16
14
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46

FIG.8

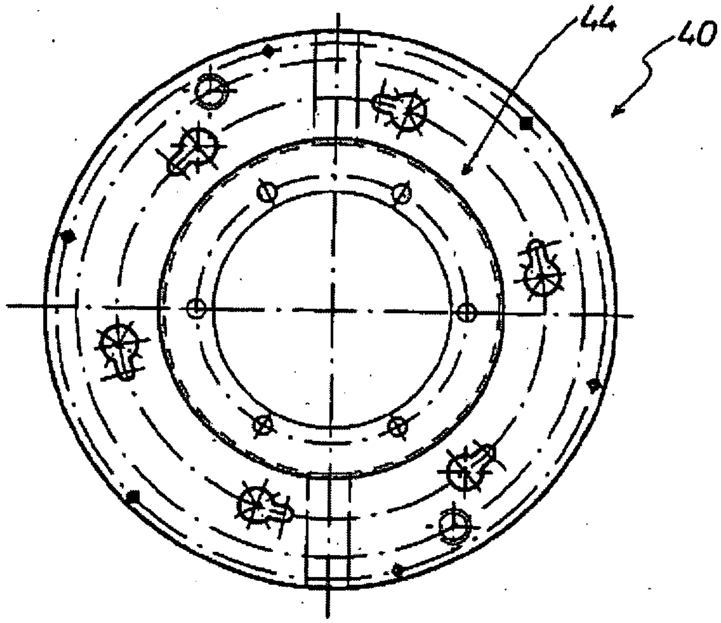

FIG.9

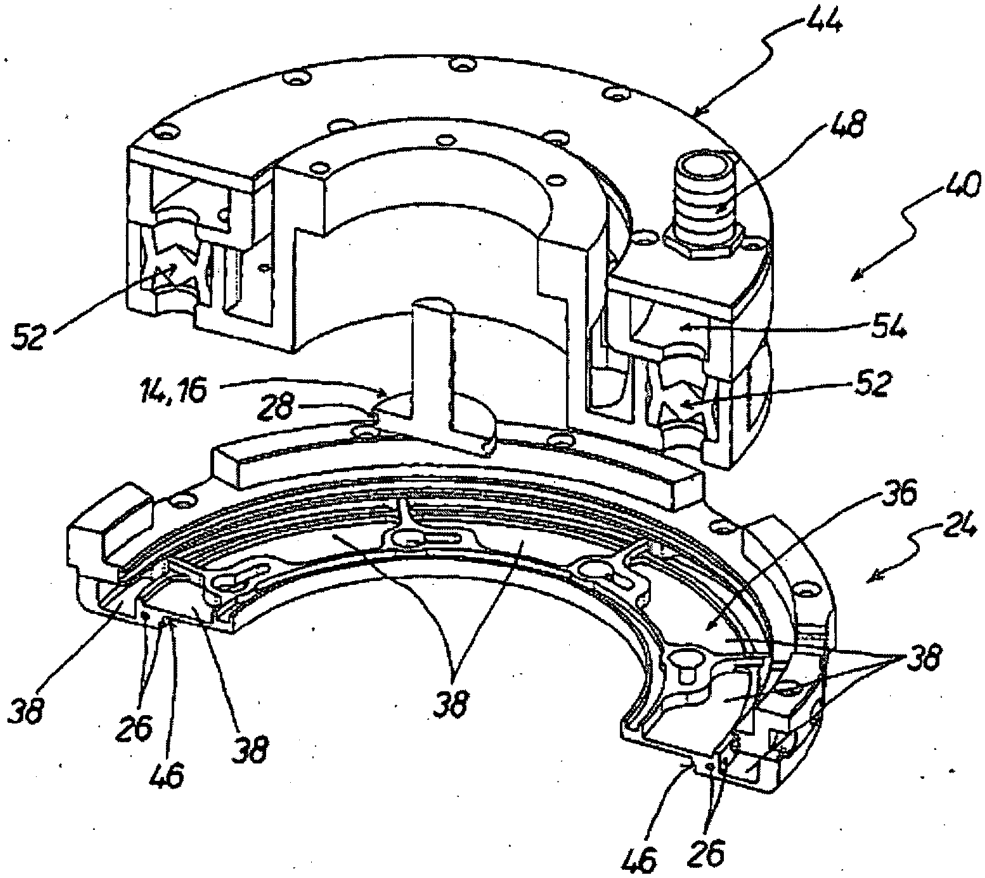

FIG.10

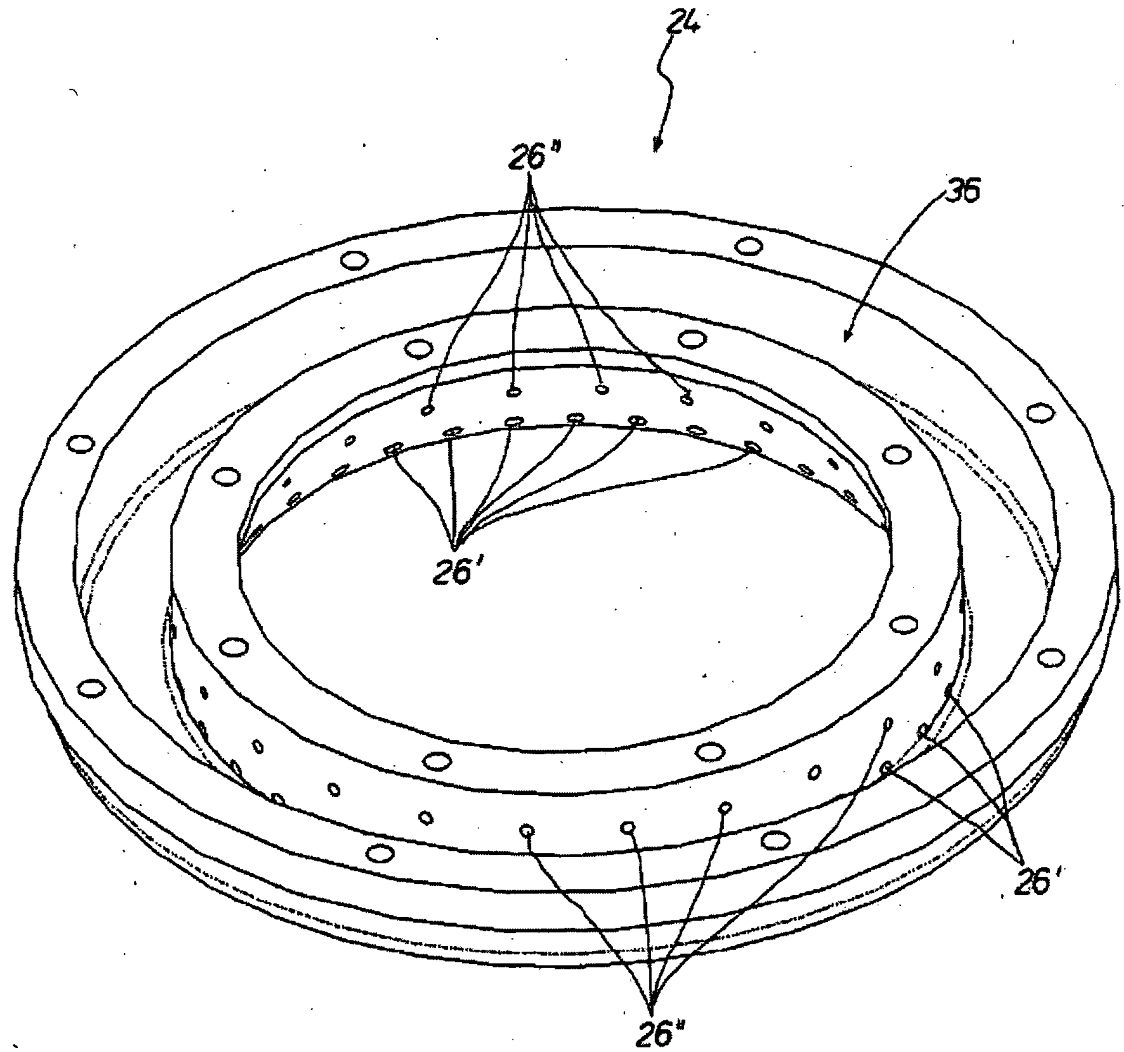

FIG.11

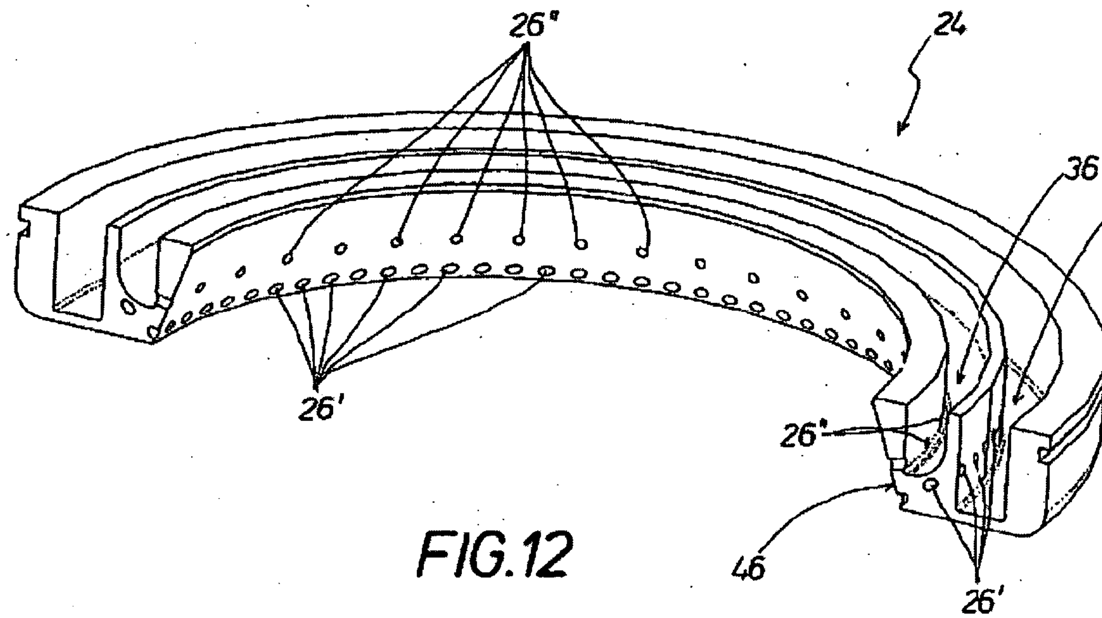

FIG.12

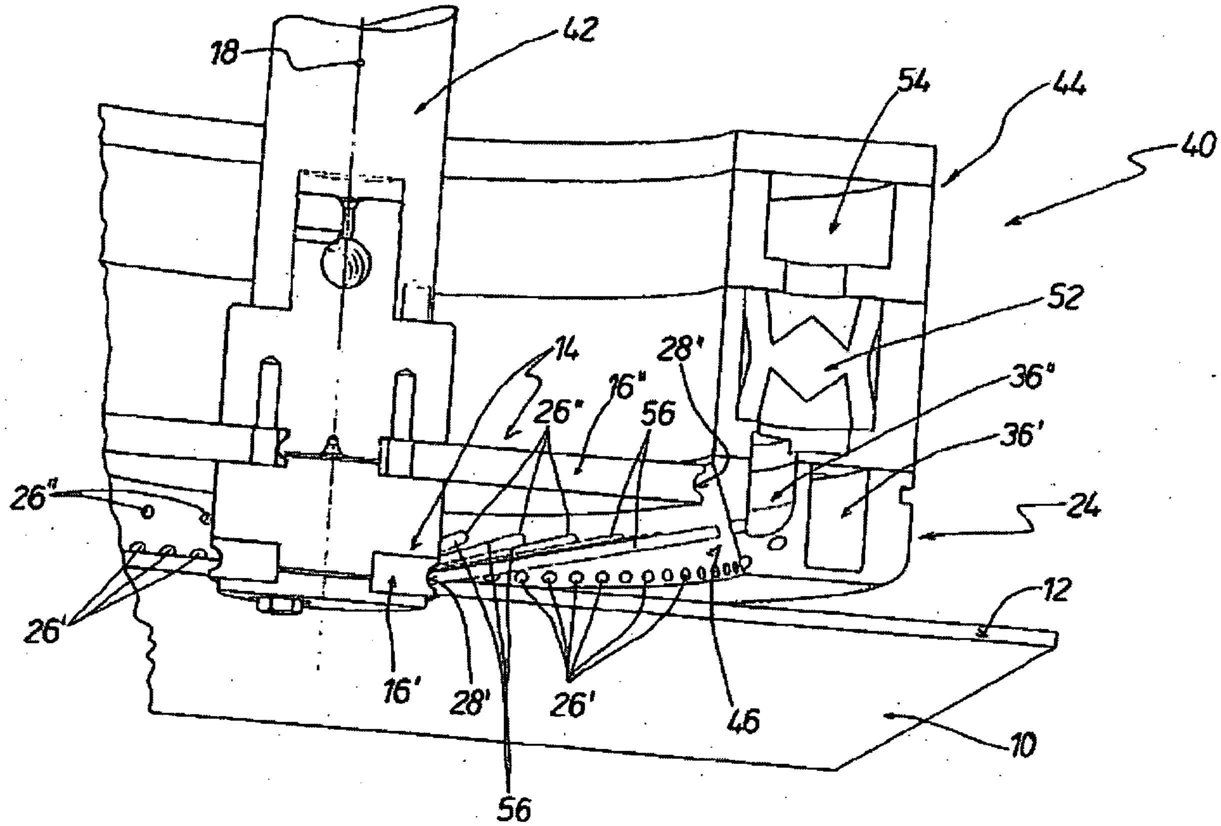

FIG.13